Lending Library: DNA Collection (DN)

Teaching Points

The information that determines an organism’s specific features is encoded within the genetic sequence of deoxyribonucleic acid (DNA). The structure of DNA is a double helix with two anti-parallel strands of nucleotides joined by phosphodiester bonds. The two strands align with a base on one strand complementing the base on the opposite strand. These complementary base pairs are connected through hydrogen bonds to stabilize the structure. With this model collection, students can:

- assemble nucleotides from sugar, phosphate and nitrogenous bases
- assemble a segment of DNA using the nucleotide units
- compare the minor and major grooves in the B-form of DNA
- explore the interaction of DNA with histones in a nucleosome
- examine the phosphodiester bonds between nucleotides
- observe a benzpyrene ring, the major carcinogen in cigarette smoke, intercalated within the double helix

Models in this Collection

- B-form DNA
- Single stranded DNA
- DNA with benzpyrene adduct
- Nucleosome
- 4 base pairs from the DNA Discovery Kit©

Documentation Included

- How do the models fit back in the suitcase?
General Model Information

- All plaster models are made with the ZCorp 3D printer.
- 3 DNA models are shown in CPK coloring scheme.
- CPK coloring:
  
<table>
<thead>
<tr>
<th>Carbon</th>
<th>Oxygen</th>
<th>Nitrogen</th>
<th>Hydrogen</th>
<th>Phosphorus</th>
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Model Details

- 2 B-form DNA models (PDB: b-dna-10-bp)
  - 1 single stranded model
    - 10 bases of DNA wrapped in a right-handed helix
  - 1 double stranded model
    - 10 base pairs of DNA wrapped in a right-handed double helix
  - Taken from idealized 24 base pair B-DNA
  - Shown in spacefill format
- DNA with benzpyrene adduct (PDB: 1agu)
  - 11 base pairs of B-DNA with benzpyrene intercalated between bases
  - Model is shown in ball-and-stick format and colored in CPK
  - Benzopyrene adduct is colored yellow
- Nucleosome (PDB: 1aoi)
  - Nucleosome core particle containing 8 histone proteins and 146 base pairs of DNA
  - DNA in backbone format and colored white with base pairs represented by struts connecting the phosphates of opposite strands
  - Histone proteins in spacefill format and shown in different colors:
    - Histone H2a is yellow
    - Histone H2b is red
    - Histone H3 is blue
    - Histone H4 is green
- DNA Discovery Kit©
  - 2 each of adenosine, thymine, guanine and cytosine nucleotides (with labels)
  - Each nucleotide has magnets for joining 3’OH to adjacent nucleotide at 5’ phosphate; magnets also demonstrate hydrogen bonding between base pairs.
  - Nucleotides can be dismantled to show phosphate group, deoxyribose, and nitrogenous base. Please reassemble nucleotides before returning models to the Lending Library.